Test Manual

The Tactile Test of Basic Concepts

A Tactile Analog to the Boehm Test of Basic Concepts, Form A

Hilda R. Caton

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INTRODUCTION

The Tactile Test of Basic Concepts (TTBC) is a tactile analog to the Boehm Test of Basic Concepts, Form A (BTBC) and is, therefore, designed to accomplish the same purpose as the BTBC. For this reason, the test manual for the BTBC is included with the TTBC materials. It is suggested that the following sections of the BTBC manual be consulted prior to using the TTBC:

(a) Information for the Teacher, pp. 3-4

(b) Interpretation, pp. 12-17

(c) Technical Data, pp. 18-29

This information is not specific to the TTBC, but is relevant to the test from which it was developed, and can be used in the interpretation of TTBC test results.

Development

Purpose

The TTBC was developed directly from the BTBC as it was designed for normally seeing children. In its original form, the BTBC is a picture test which is appropriate for use with children in kindergarten, first, and second grades. Its basic purpose is to appraise the young child's mastery of concepts that are commonly found in preschool and primary grade instructional materials and that are essential to understanding oral communications from teachers and fellow pupils (Boehm, 1971). The TTBC is a tactile test designed to accomplish the same purpose and is intended for use by children who require braille and other tactile media in their educational programs.

Description

The TTBC consists of 50 plastic cards on which the 50 items of the BTBC are presented in the form of raised outline drawings. These drawings represent the same concepts as those presented in the BTBC and are arranged in the same order. Whenever possible, simple geometric forms are used to present the concepts in the TTBC. When the concept cannot be presented in this manner, the drawings are simplified as much as possible. The simple raised drawings were used for the following reasons:

1. The substitution of real items for the original drawings was undesirable because of the

difficulty in obtaining items which accurately represented the picture, and, also, because of the difficulty young children would have in manipulating so many objects in a test situation.

2. Exact duplications of the majority of the pictures in the BTBC in raised form would result in extremely detailed and complex drawings. Such drawings are difficult for young blind children to interpret and the complexity often distracts these children from the task to which they should attend.
3. The majority of young blind children have had some experience with simple raised geometric forms and, therefore, would be less likely to be confused and distracted by them than by other types of drawings. Vermeiji (1969) has shown that geometric forms are easily identified by young blind children. In addition, Caton (1974) found that blind children of kindergarten age had no difficulty in identifying geometric forms.

Specific items on the TTBC present concepts in the same context as those on the BTBC. This procedure was followed for two basic reasons. First, the TTBC was a direct translation of the BTBC from print to tactile form. To have included concepts in other contexts on the TTBC would have resulted in a different test rather than an analog to the original test.

Secondly, particular care was taken to present concepts on the TTBC in only one context because of the nature of the acquisition of concepts by blind children. Since their acquisition of concepts such as those on the TTBC is primarily accomplished through tactual exploration, they are usually not able to acquire more than one contextual meaning of a concept at any one time. For example, the concept of "over" as related to a geometric form over a line is an entirely different concept than "over" as related to an object which is over the head. For seeing children, the similarity of the two meanings of "over" can be grasped through one visual observation because two separate examples of the concept can be viewed visually at the same time. For blind children, a simultaneous exposure to the two meanings of the concept is very difficult because the two meanings must be displayed in two different tactile forms. Unfortunately, it is usually not possible to examine them both tactually at the same time. Therefore, the different meanings of the two

concepts cannot be acquired simultaneously by blind children. For this reason, the two meanings are more appropriately presented to blind children in two different tactile formats and, usually, in two different tests.

ADMINISTRATION AND SCORING

General Directions

Administration

Since the tasks on the TTBC must be preformed tactually by young blind children, it is administered individually rather than as a group test. The test cards are numbered 1-50, but are not divided into two sets to correspond to the two booklets of the BTBC. The entire 50 items may be administered in a single session if desired. However, experience with the field test groups has indicated that, for younger children, it is advisable to administer the test in two separate sessions since young children are often not able to respond alertly to all 50 items in a single session. If the test is administered in two sessions, cards 1-25 should be used in the first session and cards 26-50 in the second. This is the only appropriate place to break the administration of the test.

Prior to the actual administration of the test, the student is presented with five practice cards, one card at a time (cards P1-P5). Cards P1-P4 each contain one of the raised outline geometric forms used on the test cards—circle, square, triangle, rectangle. Card P5 contains three of the forms in a row and simulates actual items on the test. These cards are used to familiarize the student with the test task and to determine whether he is familiar with the geometric forms used in the test. If the student does not know the forms, cards P1-P5 may be used to teach them. The forms should be taught prior to administering the test to insure that students are responding to the test task of identifying the concept presented in each item and not to the task of identifying specific geometric forms.

When the student has demonstrated an understanding of the geometric forms and the task of the test, the 50 cards of the TTBC are presented. Statements describing the raised line drawings on each card are read by the examiner and the student responds by pointing to the drawing described. Allow enough time for the child to respond to each question before going on to the next one. With very young children, it may be necessary to guide their hands across the card and show them

where the drawings are located. Be careful, however, not to point to any particular drawing within the set.

The test should be administered in a quiet room with as few distractions as possible. Only the student and the examiner should be present. Equipment should consist of a table, or desk, and comfortable chairs for both the student and examiner. Be sure that there is enough room on the table, or desk, for the student to examine the test card and that he can reach the card easily and comfortably.

Scoring

The testing materials consist of the test manual, a class record form for scoring the students' performance, and the TTBC cards. Each child's performance on the TTBC is scored on the class record form when the test is administered. Test performance is scored by entering a check mark beside each item answered correctly. The number of check marks is counted and totals are entered in the appropriate columns on the right side of the form and at the bottom of the form. The right column indicates the number of children who answer each item correctly and the bottom column indicates the number of items answered correctly by each child. This provides a quick check for the teacher as to which concepts a particular child is having difficulty with and also indicates which concepts are difficult for the majority of the children in her class.

Detailed Directions for Administering

Detailed directions for administering the TTBC are given below. These directions should be followed exactly, with the numbered questions being read aloud to students. The key phrases in each item are read twice, with emphasis on the italicized words.

Practice Cards

Before administering the test, use the five practice cards to familiarize students with the figures which will be encountered. Begin by saying:

> In a few minutes I am going to show you some cards with figures on them and ask you to find some special things on them. But, first, I will show you some of the kinds of figures you will see. Here is a circle (present card P-1). Be sure to examine it carefully so that you will know exactly what it is like (show child how

to trace the figure). Here is a square (present card P 2). Examine it just the way you examined the circle so that you will know exactly what it is like. Here is another figure (present card P 3). This is a rectangle. Examine it carefully just as you did with the circle and square. This figure is called a triangle (present card P 4). Examine it carefully so that you will know what it is like.

The card I will show you now has more than one figure on it (present card P 5). The cards I told you about will be like this card. You must be careful to examine all the figures on the card (help the child to examine all the figures, show him how to go all the way across the card). Good, now we are ready to begin.

Test Cards

Give the student the first card. Place the card so that the number is on the student's right and the card is directly in front of him. Then start reading the test questions. Do *not* read the numbers.

1. Look at the rectangles with dots in them. Examine every rectangle on the card. Now, put your finger on the rectangle with the dot at the *top*—Put your finger on the rectangle with the dot at the *top*.

2. Look at the squares and dotted lines. Be sure to examine all the squares and lines. Now, put your finger on the square with the line *through* it—Put your finger on the square with the line *through* it.

3. Look at the rectangle and circles. Put your finger on the circle that is *away from* the box—Put your finger on the circle that is *away from* the box.

4. Look at the figures on this card. Put your finger on the figure that is *next to* the circle—Put your finger on the figure that is *next to* the circle.

5. Look at the squares and dots. Put your finger on the square with the dot *inside* it—Put your finger on the square with the dot *inside* it.

6. Look at the squares and dots. Be sure to examine all the squares on the card. Now, put your finger on the square that has *some but not many* dots in it—Put your finger on the square that has *some but not many* dots in it.

7. Look at the lines on the card. Be sure to examine them all. Now, put your finger on the line that is in the *middle*—Put your finger on the line that is in the *middle*.

8. Look at the circles and dots. Look at all the figures on the card. Put your finger on the circle that has a *few* dots in it—Put your finger on the circle that has a *few* dots in it.

9. Look at the circles on this card. Be sure to look at all of them. This is the bottom of the card. (Place the child's hand on the bottom of the card). Now, put your finger on the circle that is *farthest* from the bottom—Put your finger on the circle that is *farthest* from the bottom.

10. Look at the squares and dots. Put your finger on the square that has dots *around* it—Put your finger on the square that has dots *around* it.

11. Look at the line and the triangles. Put your finger on the triangle that is *over* the line—Put your finger on the triangle that is *over* the line.

12. Look at the rectangles. Be sure to look at all of the rectangles on the card. Now, put your finger on the rectangle that is *widest*—Put your finger on the rectangle that is *widest.*

13. Look at the rectangles with dots in them. Look at all of them. Now, put your finger on the rectangle that has the *most* dots—Put your finger on the rectangle that has the *most* dots.

14. Look at the rectangles, squares, and circles. Put your finger on the figure that is *between* the circles—Put your finger on the figure that is *between* the circles.

15. Look at the circles on the card. Be sure to examine them all. Put your finger on the circle that is *whole*—Put your finger on the circle that is *whole.*

16. Look at the circles and the square. Be sure to look at all the figures. Put your finger on the circle that is *nearest* the square—Put your finger on the circle that is *nearest* the square.

17. Look at the squares in a row. Start here. (Place child's hands at the left side of the card.) Put your finger on the *second* square—Put your finger on the *second* square.

18. Look at the rectangle and the dots. Put your finger on the dot that is at the *corner* of the rectangle—Put your finger on the dot that is at the *corner* of the rectangle.

19. Look at the sets of circles, squares, and triangles. Examine each set carefully. Put your finger on the set that has *several* circles—Put your finger on the set that has *several* circles.

20. (Blank card) Now, I'd like you to get up and stand *behind* your chair—Get up and stand *behind* your chair.

21. Look at the sets of dots. Be sure to look at every set on the card. Put your finger on the set where all the dots are in a *row*—Put your finger on the set where all the dots are in a *row.*

22. Look at the squares on the card. Be sure to examine them all. Now, put your finger on the square that is *different* from the others—Put your finger on the square that is *different* from the others.

23. Look at the drawings of strings. Put your finger on the drawing that shows how the string looked *after* it was cut—Put your finger on the drawing that shows how the string looked *after* it was cut.

24. Look at the squares with dots in them. Put your finger on the square that is *almost* empty—Put your finger on the square that is *almost* empty.

25. Look at the circles. Be sure to look at them all. Now, put your finger on the one that is *half* gone—Put your finger on the one that is *half* gone.

The administration of the test may be broken at this point if desired. It should not be broken at other points in the test.

26. Look at the circle and the dots. Put your finger on the dot that is at the *center* of the circle—Put your finger on the dot that is at the *center* of the circle.

27. Look at the rectangle with the dots in it and at the sets of dots on the card. Be sure to find all the sets of dots. Put your finger on the set that has *as many* dots as the rectangle—Put your finger on the set that has *as many* dots as the rectangle.

28. Look at the square and the circles. Put your finger on the circle that is at the *side* of the square —Put your finger on the circle that is at the *side* of the square.

29. Look at the lines and the dots on the card. Be sure to look at all of them. Start at this side of the card. (Put child's hand on the left side of the card.) Put your finger on the dot that is at the *beginning* of the line—Put your finger on the dot that is at the *beginning* of the line.

30. Look at the shapes. One is a circle and one is a square. Put your finger on the *other* shape— Put your finger on the *other* shape.

31. Look at all the shapes on the card. Put your finger on the shapes that are *alike*—Put your finger on the shapes that are *alike.*

32. Look at the squares in a row. Here is the beginning of the row. (Place child's hands on the left side of the card.) Put your finger on the square that is *not the first and not the last*— Put your finger on the square that is *not the first and not the last.*

33. (Blank card) Pretend that you have a chair, an apple, and some cookies. Which one would a child *never* eat—Which one would a child *never* eat.

34. Look at the line on the card. Put your finger *below* the line—Put your finger *below* the line.

35. Look at the squares and circles. Put your finger on the circle that *matches* one of the squares— Put your finger on the circle that *matches* one of the squares.

36. Look at the circle, the square, and the hand. Put your finger on the one a child *always* has— Put your finger on the one a child *always* has.

37. Look at the circles. Be sure to examine them all. Put your finger on the circle that is *medium-sized*—Put your finger on the circle that is *medium-sized.*

38. Look at the squares and the line. Put your finger on the square that is over the *right* end of the line—Put your finger over the *right* end of the line.

39. (Blank card) Stand up. Step away from your chair so that you will have plenty of room. Now, bend *forward*—Bend *forward.*

40. Look at the rectangles and the dots. Put your finger on the rectangle that has *zero* dots— Put your finger on the rectangle that has *zero* dots.

41. Look at the line and the circles. Be sure you find all the circles on the card. Put your finger on the circle that is *above* the line—Put your finger on the circle that is *above* the line.

42. Look at the sets of circles with dots in them. Be sure to examine all the sets carefully. Put your finger on the set that has a dot in *every* circle—Put your finger on the set that has a dot in *every* circle.

43. Look at the beads. Put your finger on the beads that are *separated*—Put your finger on the beads that are *separated.*

44. Look at the triangles. Be sure to look at all of them. Put your finger on the triangle on the *left*—Put your finger on the triangle on the *left.*

45. Look at the sets of lines. Be sure to examine all the sets. Put your finger on the set that shows a *pair* of lines—Put your finger on the set that shows a *pair* of lines.

46. Look at the squares. Find the square that has some dots in it. Now, *skip* a square and put your finger on another square—*Skip* a square and put your finger on another square.

47. Look at the sets of lines. Examine every set carefully. Put your fingers on the sets that have *equal* numbers of lines—Put your fingers on the sets that have *equal* numbers of lines.

48. Look at the rows of circles. Examine each row carefully. Put your finger on the row where the circles are *in order* from large to small—Put your finger on the row where the circles are *in order* from large to small.

49. Look at the square and the circles. Put your finger on the *third* circle from the square—Put your finger on the *third* circle from the square.

50. Look at the sets of circles. Be sure that you have examined every set on the card. Put your finger on the set that has the *least* number of circles—Put your finger on the set that has the *least* number of circles.

TECHNICAL DATA

The empirical evaluation of the TTBC consisted of two pilot tests and a field test. The pilot tests were designed to provide information regarding the most appropriate form for the raised line drawings used in the test. The two forms considered were solid raised figures and raised outline figures. The field test was conducted to provide performance data to assist in the interpretation of test scores on the TTBC, to establish reliability, and determine concurrent validity for the TTBC.

Pilot Tests

Two pilot tests were conducted to determine the most appropriate form for the raised drawings used in the TTBC. The form of the drawings used in the first pilot test was solid raised drawings and the form used in the second pilot test was raised outline drawings.

$\underline{T}$ tests were used to compare the mean performances of the two groups on the pilot tests. Results showed a very slight mean difference in favor of the raised outline figures, but the $\underline{t}$ ratio (.1719) between the two means was not significant. Therefore, it was assumed that the form in

which the raised geometric figures were presented (solid raised figures or raised outline figures) did not significantly affect students' ability to make the necessary discriminations.

Since the performance of subjects using the two forms of the TTBC was not significantly different and since the majority of raised drawings found in curricular materials used by visually handicapped children are in raised outline form, the raised outline figures were used in the field test.

Field Test

The purpose of the field test of the TTBC was to provide performance data to assist in the interpretation of test scores on the TTBC, to establish reliability, and determine concurrent validity for the test. In order to establish reliability, the performance of blind subjects alone was analyzed. To provide performance data, the performance of blind subjects alone was analyzed and, also, the performance of blind and seeing subjects was compared. The concurrent validity was established through a comparison of the performance of blind and seeing children. Both the BTBC and the TTBC were considered to be content valid since the items on both tests are identical and are taken directly from curricular materials used by both blind and seeing children.

Blind subjects for the field test were 75 blind students, 25 in each of grades K–2, who either used braille or who would eventually use braille as their reading medium. Subjects were drawn from six residential school programs and six public day school programs for visually handicapped students. Participating schools and school systems are listed in Table 1.

Table 1

Schools Participating in the Field Test

1. Cincinnati Public School, Cincinnati, Ohio
2. Columbus Public Schools, Columbus, Ohio
3. DeKalb County Public Schools, Decatur, Georgia
4. Florida School for the Deaf and the Blind, St. Augustine, Florida
5. Governor Morehead School, Raleigh, North Carolina
6. Indiana School for the Blind, Indianapolis, Indiana
7. Logan Day School, Philadelphia, Pennsylvania
8. Missouri School for the Blind, St. Louis, Missouri
9. Ohio State School for the Blind, Columbus, Ohio
10. Overbrook School for the Blind, Philadelphia, Pennysylvania

11. St. Louis County Public Schools, St. Louis, Missouri
12. Toledo Public Schools, Toledo, Ohio

Sighted subjects whose performance on the BTBC was compared with the performance of blind subjects on the TTBC were those used in the standardization sample for the BTBC. Data for these comparisons were taken from the test manual for the Boehm Test of Basic Concepts (Boehm, 1971).

Performance Data – Blind Subjects

Prior to the development of performance data for the TTBC, eight subject characteristics considered to be relevant to performance on a school related test were identified. Those variables were grade placement, age, years in school, sex, race, socioeconomic level, type of school placement, and amount of vision.

In order to take into account the possible effects of these variables upon the performance of the subjects, correlations measuring the relationship of each variable to performance on the TTBC were computed. The product moment correlation coefficient was obtained where both variables were continous: Grade vs. Performance, Age vs. Performance, and Years in School vs. Performance. In instances where one variable was dichotomous, the point-biserial coefficient was obtained: Sex vs. Performance, Race vs. Performance, Socioeconomic Level vs. Performance, School Placement vs. Performance, and Amount of Vision vs. Performance. Since the blind subjects in the study fell within two socioeconomic levels, this variable was considered to be dichotomous. Also, since amount of vision was considered in terms of light perception, and no light perception, this variable was also considered to be dichotomous. A summary of significant correlations obtained from these analyses is presented in Table 2:

Table 2

Correlation of Subject-Characteristic Variables
with Test Performance

Variable	Correlation
Grade placement	.50**
Age	.28*
Years in school	.29**
Type of school placement (residential or public)	.35**

*p .05
**p .01

Since grade level was most positively correlated with performance of blind students on the test, subsequent analyses were made on the basic of this variable.

To futher specify the relationships of these variables to test performance, mean TTBC scores and standard deviations for levels within each of the significant variables are given in Table 3:

Table 3

Means and Standard Deviations for Levels of Subject Characteristic Variables

Variable	Mean	SD
Grade placement		
Kindergarten	32.00	6.52
First	35.16	7.00
Second	41.56	6.81
Age		
4	33.00	(one subject)
5	33.30	6.71
6	34.46	7.15
7	37.92	7.82
8	37.60	7.43
9	39.73	9.93
Years in school		
1	32.91	6.46
2	33.63	5.86
3	40.67	6.84
4	34.11	10.31
5	42.00	4.24

Table 3 (continued)

Variable	Mean	SD
School placement		
Public	40.46	6.55
Residential	34.49	7.65

Using this information, performance data for the TTBC were then reported in the form of order of item difficulty and percentage passing scores by grade level. Categories of difficulty were also developed to assist in the interpretation of scores on the TTBC. In addition, a separate analysis of variance was conducted in order to determine whether the ability of blind subjects to identify concepts on the TTBC increased by grade level.

Order of Difficulty of Items on the TTBC

The order of difficulty of items on the TTBC is based on the performance of blind subjects only. Items were administered to the 75 blind subjects participating in the study in the order in which they occur in the BTBC. The scores of each subject were tabulated on the basis of the number of correct and number of incorrect responses to each item. Item difficulties were then calculated for each item by dividing the total number of subjects attempting each item into the total number of correct responses to each item. The resulting percentage of correct responses to an item was considered to be the index of difficulty for that item. The total 50 items were then ranked according to the indices of difficulty with the highest index of difficulty considered to be the easiest item and the lowest index of difficulty considered to be the most difficult item. Table 4 presents the items on the TTBC in their order of difficulty when presented to blind subjects.

Table 4

Order of Difficulty for Items on the TTBC

Item	Index of difficulty	Item	Index of difficulty
1. Behind	.96	26. Second	.75
2. Next to	.95	27. Right	.72
3. Always	.95	28. Between	.71
4. Nearest	.94	29. Equal	.71

Table 4 (continued)

Item	Index of difficulty	Item	Index of difficulty
5. Away from	.89	30. Center	.69
6. Around	.89	31. Above	.69
7. Several	.85	32. Side	.68
8. After	.85	33. Skip	.68
9. Other	.85	34. Few	.67
10. Inside	.84	35. As many	.65
11. Corner	.84	36. Zero	.65
12. Top	.83	37. Every	.65
13. Most	.81	38. Different	.64
14. Row	.81	39. Farthest	.63
15. Almost	.81	40. Alike	.63
16. Forward	.81	41. Below	.61
17. Whole	.79	42. Separated	.61
18. Not first or last	.79	43. Half	.59
19. Never	.79	44. Middle	.57
20. Through	.77	45. Medium-sized	.57
21. Beginning	.76	46. Third	.53
22. Left	.76	47. In order	.51
23. Some, not many	.75	48. Pair	.47
24. Over	.75	49. Matches	.43
25. Widest	.75	50. Least	.43

An inspection of the table reveals that for 16 sets of items, the indices of difficulty were tied (i.e., for items 2 [next to] and 3 [always] the index of difficulty was .95, for items 5 [away from] and 6 [around] the index of difficulty was .89, etc.). Items within these 16 sets were assigned randomly to specific ranks.

Percentage Passing Each Item on the TTBC by Grade Level

Percentage passing scores for each item, were computed by grade level. The procedure for calculation was to divide the total number of subjects attempting the item, in each grade, into the total number of correct responses for that grade. These scores may be viewed as very general indices of performance of blind subjects on the TTBC. The scores are presented in Table 5.

Table 5

Percent Passing Each Item by Grade Level

	Kindergarten	Grade 1	Grade 2
1 Top	80	80	88
2 Through	72	72	88
3 Away from	76	92	100
4 Next to	92	92	100
5 Inside	88	84	80
6 Some, not many	76	64	84
7 Middle	52	48	72
8 Few	60	68	72
9 Farthest	52	60	76
10 Around	92	80	96
11 Over	76	68	80
12 Widest	72	64	88
13 Most	80	76	88
14 Between	56	64	92
15 Whole	64	80	92
16 Nearest	84	96	100
17 Second	56	72	96
18 Corner	80	88	84
19 Several	80	84	88
20 Behind	92	96	100
21 Row	72	84	88
22 Different	52	56	84
23 After	72	92	92
24 Almost	76	72	96
25 Half	56	48	72
26 Center	64	68	76
27 As many	64	52	80
28 Side	44	80	80
29 Beginning	56	84	88
30 Other	84	80	92
31 Alike	60	64	64
32 Not first or last	64	76	96
33 Never	68	72	96
34 Below	44	60	80
35 Matches	44	48	36

Table 5 (continued)

	Kindergarten	Grade 1	Grade 2
36 Always	92	96	96
37 Medium-sized	44	52	76
38 Right	60	68	88
39 Forward	64	84	96
40 Zero	40	64	92
41 Above	68	64	76
42 Every	48	68	80
43 Separated	52	60	72
44 Left	68	72	88
45 Pair	40	36	64
46 Skip	44	76	84
47 Equal	60	76	76
48 In order	48	40	64
49 Third	36	44	80
50 Least	36	52	40

The two indices above should not be viewed in isolation. Although they do represent the performance of a substantial percentage of blind students (9%) enrolled in grades K-2, in 1974, from a relatively wide geographic range, and from both public and residential school programs, they should be used in conjunction with the data provided in Tables 2 and 3. Used in this way, the two indices do provide a relatively valid basis for judging the performance of other blind children. For example, correlations of test performance and subject characteristic variables in Table 2 indicate that interpretation of scores of blind children on the TTBC should take into consideration the possible effects of grade placement, age, years in school, and type of school placement. The means and standard deviations in Table 3 indicate a slightly higher level of performance for blind subjects who are older, have more years in school, and are at higher grade levels. In addition, these data seem to indicate that blind subjects enrolled in public school programs perform at a slightly higher level than those enrolled in residential school programs. All of these facts should be taken into consideration in any interpretation of scores by blind students on the TTBC.

Categories of Item Difficulty on TTBC

Categories of item difficulty provide information to test users which is indicative of the types of

curricular concepts with which blind children might encounter problems. To establish these categories, the data were examined and items which tended to group themselves into specific categories on the basis of ease or difficulty were identified. Items were then grouped according to their difficulty—from least difficult to most difficult.

An examination of item difficulties for the total 50 items on the TTBC did not reveal a strong tendency for items to group themselves into categories of difficulty. In general, however, items for which the blind child was required to use himself as a referent appeared to be easiest. These items were: behind, next to, always, nearest, away from, and around. The indices of difficulty for these items ranged from .89 to .96. Items which required the ability to make comparative judgements tended to be the most difficult. These items were half, middle, medium-sized, third, in order, pair, matches, and least. The indices of difficulty for these items ranged from .43 to .49. Items who indices of difficulty fell between .49 and .89 did not follow a specific pattern in relation to difficulty. Specific item difficulty indices for the least difficult and most difficult items are given in Table 6.

Table 6

Least Difficult and Most Difficult Items on TTBC

Least Difficult		Most Difficult	
Item	Index of difficulty	Item	Index of difficulty
Behind	.96	Half	.59
Next to	.95	Middle	.57
Always	.95	Medium-sized	.57
Nearest	.93	Third	.53
Away from	.89	In order	.51
Around	.89	Pair	.47
		Matches	.43
		Least	.43

Increase in Ability of Blind Children to Identify Concepts on the TTBC by Grade Level

A one-factor analysis of variance was used to determine whether the ability of blind children to identify concepts on the BTBC increased with grade level. When differences occurred, the Tukey multiple comparison procedure was used to determine where the specific mean differences occurred.

The comparison of the performance of blind children on the TTBC using the analysis of variance indicated that there were significant differences in this performance by grade level ($F = 12.89$). Futher, the multiple comparsion procedure showed that these differences occurred between kindergarten and second grade and between first and second grade with no significant difference between kindergarten and first grade. An examination of means and standard deviations (Table 7) reveals that there is an increase in ability to identify items on the TTBC by grade level, indicating that blind children do learn these concepts as they progress in school.

Table 7

Means and Standard Deviations of Blind Students on TTBC

Grade level	Mean	SD
Kindergarten	32.00	6.52
First grade	35.16	7.00
Second grade	41.56	6.81

Performance Data—Blind and Seeing Subjects

Comparisons of the performance of blind subjects on the TTBC with the performance of seeing subjects on the BTBC were made in order to provide additional performance data. Two major comparisons were made. These were a comparison of the difficulty of each item on the BTBC (seeing subjects) with the difficulty of the same item on the TTBC (blind subjects) for each grade level and a comparison of the original order of difficulty of items on the BTBC with the new order of difficulty of items on the TTBC.

Comparison of Individual Item Difficulty

Chi-square (X^2) analyses were used to compare the difficulty of each item, by grade level, on the BTBC (seeing subjects) with the difficulty of the same item on the TTBC (blind subjects). The analyses were conducted by comparing the number of correct and incorrect responses made to each item by blind subjects with the number of correct and incorrect responses made to each item by seeing subjects. The purpose of these analyses was to indentify specific items which were significantly more difficult or significantly less difficult for blind subjects using the TTBC. For each

grade level, some items were significantly different in terms of difficulty for blind and seeing subjects. These items are presented in Table 8.

Table 8

Items Significantly Different in Difficulty for Blind Subjects

	Kindergarten	First Grade	Second Grade
Less Difficult	Other	Always	
	Never	Forward	
	Always	Equal	
	Equal		
More Difficulty	Middle	Through	Top
		Some, not many	Through
		Middle	Inside
		Farthest	Some, not many
		Around	Middle
		Over	Farthest
		Widest	Over
		Most	Most
		Between	Corner
		Different	Half
		Half	Alike
			Matches

Information in Table 8 may be used to assist in the interpretation of test scores on the TTBC. However, it should be used only in conjunction with the other technical data presented in this manual.

Comparison of Order of Difficulty

In order to establish the relationship of the order of difficulty of the 50 items on the BTBC and the order of difficulty of the same 50 items on the TTBC, the Spearman Rank-order Correlation coefficient was computed. The original order of the 50 items on the BTBC was compared to the order of difficulty of the same items on the TTBC which is given in Table 4. Since there were 16 tied ranks for the items on the TTBC, the formula used was that suggested by Siegel (1956, p.207) for cases where a considerable number of ties are present. The resulting correlation coefficient was .49, indicating a moderate, though not strong, relationship between the two orders of difficulty. Since the relationship is only moderate, it is suggested that the order of items on the TTBC remain

the same as that on the BTBC. However, the order of difficulty of items on the TTBC is given in Table 4 and can be used.

Reliability

The reliability of the TTBC was estimated by the Kuder-Richardson reliability coefficient. This reliability coefficient is based on the consistency of the subjects' responses to all items on the test and provides a measure of both equivalence (as in split-half methods) and homogeneity of items (Anastasi, 1966). The Kuder-Richardson reliability for the total TTBC was .87, indicating relatively strong internal consistency for the test. In addition, the standard error of measurement (SE_m) was computed to provide an estimate of the amount of error associated with individual test scores. The SE_m for the TTBC was 2.8. Since this SE_m is relatively small, the amount of confidence which can be placed in individual test scores is increased. Thus, it appears that the TTBC can be considered a relatively reliable instrument.

Validity

Comparisons of the performance of blind and seeing subjects were also made to determine the concurrent validity of the TTBC. A 2 x 3 analysis of variance was used in these comparisons. Results of the analysis provided comparisons of the performance of blind subjects over grade level, comparisons of the performance of seeing subjects over grade level, comparisons of the performance of blind and seeing subjects within grade level, and an indication of any interaction between the factors of grade and vision. The performances of six groups were compared. These groups were: (1) blind kindergarten, (2) seeing kindergarten, (3) blind first grade, (4) seeing first grade, (5) blind second, and (6) seeing second grade. The assumption was made that, if the performances of the blind and seeing groups were not significantly different, the same purpose was accomplished by the TTBC and the BTBC and concurrent validity could be claimed for the TTBC.

Results of the comparisons did, in fact reveal no significant difference between the performances of blind and seeing subjects ($F = .672$). On this basis, it was concluded that the TTBC did accomplish this same purpose for blind children as that accomplished for seeing children by the BTBC. As a result, concurrent validity was assumed for the TTBC.

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Directions: Enter the names of the children tested. In the column below a child's name, record his test performance by entering a check mark (✓) for each item answered correctly. Then count the ✓'s in each row and column, and enter the totals in the appropriate row and column. Enter the total of all rows and columns in the appropriate box.

Concept	Child's Name 1	2	3	4	5	6	7	8	9	10	Total Number of Children Answering Correctly
1. Top											
2. Through											
3. Away from											
4. Next to											
5. Inside											
6. Some, not many											
7. Middle											
8. Few											
9. Farthest											
10. Around											
11. Over											
12. Widest											
13. Most											
14. Between											
15. Whole											
16. Nearest											
17. Second											
18. Corner											
19. Several											
20. Behind											
21. Row											
22. Different											
23. After											
24. Almost											
25. Half											

Concept	Child's Name 1	2	3	4	5	6	7	8	9	10	Total Number of Children Answering Correctly
26. Center											
27. As many											
28. Side											
29. Beginning											
30. Other											
31. Alike											
32. Not first or last											
33. Never											
34. Below											
35. Matches											
36. Always											
37. Medium-sized											
38. Right											
39. Forward											
40. Zero											
41. Above											
42. Every											
43. Separated											
44. Left											
45. Pair											
46. Skip											
47. Equal											
48. In order											
49. Third											
50. Least											
Sum of Items Ans. Correctly											